CLAIMS

WE CLAIM:

1. A method of IR correction for use in an ECMP cell having, within an electrolyte, at least a working electrode, a counter electrode, and a reference electrode adjacent to the working electrode, the method comprising:

measuring a voltage transient between the reference electrode and the working electrode resulting from application of a substantially square step function test signal to the ECMP cell;

deriving from the voltage transient a measure of the resistive impedance of the ECMP circuit between and including the working electrode and the reference electrode; and

subsequently using the measure of resistive impedance to derive an IR correction to the measured voltage between the working electrode and the reference electrode.

2. The method of claim 1, further comprising using the IR correction to produce a corrected voltage that represents the voltage across a substantially capacitive interface between the working electrode and the electrolyte.

3. The method of claim 1, wherein the voltage between the working and reference electrodes is maintained by a potentiostat having a controlled input and having its output modified by a current limiter, wherein the method further comprises deriving the substantially square step function test signal by executing steps comprising:

applying a small square step function voltage perturbation to the potentiostat input; and

clipping the current of the potentiostat output resulting from the application of the small square step function to the potentiostat input, using the current limiter, such that the clipped current is formed into a substantially square step function.

4. The method of claim 1, wherein the step of deriving a measure of the resistive impedance of the ECMP circuit comprises converting the voltage transient to a digital representation thereof and deriving from the digital representation a measure of the resistive impedance of the ECMP circuit.

5. The method according to claim 2, further comprising using the measure of resistive impedance to control the voltage between the working electrode and the reference electrode such that the voltage across the substantially capacitive interface between the working electrode and the electrolyte is controlled to within a substantially small variance from a predetermined target value.

6. The method according to claim 5, wherein the substantially small variance is less than about 10 mv.

7. The method according to claim 1, wherein the step of measuring a voltage transient between the reference electrode and the working electrode comprises measuring the voltage between the reference electrode and the working electrode prior to, during, and after the transient.

8. The method of claim 7, wherein measurements before and after the transient are taken with a lower temporal resolution than measurements taken during the transient.

9. The method of claim 7, wherein measurements before and after the transient are taken at substantially the same temporal resolution as measurements taken during the transient.

10. A computer-readable medium having stored thereon computer-executable instructions for performing a method of IR correction for use in an ECMP cell having, within an electrolyte, at least a working electrode, a counter electrode, and a reference electrode adjacent to the working electrode, the method comprising:

measuring a voltage transient between the reference electrode and the working electrode resulting from application of a substantially square step function test signal to the ECMP cell;

deriving from the voltage transient a measure of the resistive impedance of the ECMP circuit between and including the working electrode and the reference electrode; and

subsequently using the measure of resistive impedance to derive an IR correction to the measured voltage between the working electrode and the reference electrode.

11. The computer-readable medium of claim 10, further comprising instructions for using the IR correction to produce a corrected voltage that represents the voltage across a substantially capacitive interface between the working electrode and the electrolyte.

12. The computer-readable medium of claim 10, wherein the voltage between the working and reference electrodes is maintained by a potentiostat having a controlled input and having its output clipped by a current limiter, wherein the instructions further comprise instructions for deriving the substantially square step function test signal by applying a small square step function voltage perturbation to the potentiostat input.

13. The computer-readable medium of claim 10, wherein the step of deriving a measure of the resistive impedance of the ECMP circuit comprises converting the voltage transient to a digital representation thereof and deriving from the digital representation a measure of the resistive impedance of the ECMP circuit.

14. The computer-readable medium of claim 11, wherein the instructions further comprise an instruction for using the measure of resistive impedance to control the voltage between the working electrode and the reference electrode such that the voltage across the substantially capacitive interface between the working electrode and the electrolyte is controlled to within a substantially small variance from a predetermined target value.

15. The computer-readable medium of claim 14, wherein the substantially small variance is less than about 10 mv.

16. The computer-readable medium of claim 10, wherein the step of measuring a voltage transient between the reference electrode and the working electrode comprises measuring the voltage between the reference electrode and the working electrode prior to, during, and after the transient.

17. The computer-readable medium of claim 16, wherein measurements taken before and after the transient are taken with a lower temporal resolution than measurements taken during the transient.

18. The computer-readable medium of claim 16, wherein measurements before and after the transient are taken at substantially the same temporal resolution as measurements taken during the transient.

19. An IR corrected ECMP system comprising:

an ECMP cell comprising a working electrode, a counter electrode, a reference electrode, and an electrolyte, each of the electrodes being in contact with the electrolyte;

a potentiostat for supplying current and voltage to the ECMP cell via the counter electrode to accomplish a polishing process, the potentiostat having an input and an output;

a current limiter placed in series between the potentiostat output and the counter electrode to current limit a signal at the potentiostat output prior to application of the signal to the counter electrode; and

an IR correction circuit for calculating an unwanted IR contribution to a voltage drop between the reference electrode and the working electrode by causing the potentiostat to emit one or more transient current spikes that are limited by the current limiter to form a substantially square current step function to be applied to the counter electrode, and observing the transient response of the voltage between the reference electrode and the working electrode.

20. The IR corrected ECMP system according to claim 19, wherein the current limiter is an AC current switch having two switch terminals and two additional control terminals, wherein the two switch terminals are situated in the current path and the two control terminals are used to variably set the current limit of the switch by way of a voltage applied across the control terminals.

21. The IR corrected ECMP system according to claim 20, wherein the current limiter further comprises two MOSFETs in the current path.

22. The IR corrected ECMP system according to claim 19, wherein the IR corrected circuit is further adapted for controlling the potentiostat input to control the measured voltage between the working electrode and the reference electrode such that the difference between the measured voltage and the calculated IR contribution is maintained substantially at a predetermined value.

23. A method of IR correction for use in an electrochemical cell having, within an electrolyte, at least a working electrode, a counter electrode, and a reference electrode adjacent to the working electrode, the method comprising:

applying a substantially square step function test signal to the electrochemical cell;

measuring a voltage transient between the reference electrode and the working electrode resulting from the application of the test signal, the test signal having a start point, wherein the measurement of the voltage transient comprises measuring the voltage between the reference electrode and the working electrode at three times prior to the test signal start point and at three times subsequent to the test signal start point;

deriving an extrapolated time-based voltage curve based on the measurements taken subsequent to the test signal start point;

deriving from the time-based voltage curve a measure of the resistive impedance of the electrochemical cell circuit between and including the working electrode and the reference electrode; and

subsequently using the measure of resistive impedance to derive an IR correction to the measured voltage between the working electrode and the reference electrode.

24. The method of claim 23, further comprising using the IR correction to produce a corrected voltage that represents the voltage across a substantially capacitive interface between the working electrode and the electrolyte.

25. The method of claim 23, wherein the voltage between the working and reference electrodes is maintained by a potentiostat having a controlled input and having its output modified by a current limiter, wherein the substantially square step function test signal is derived by executing steps comprising:

applying a small square step function voltage perturbation to the potentiostat input; and

clipping the current of the potentiostat output resulting from the application of the small square step function to the potentiostat input, using the current limiter, such that the clipped current is formed into a substantially square step function.

26. The method according to claim 24, further comprising controlling the voltage between the working electrode and the reference electrode such that the voltage across the substantially capacitive interface between the working electrode and the electrolyte is controlled to within a substantially small variance from a predetermined target value.

27. The method according to claim 26, wherein the substantially small variance is less than about 10 mv.